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(54) A reinforcement element for offshore work vessels

(57) A reinforcement element 13 for a semisubmersible, elastically anchored offshore work vessel, e.g. for development of oil and gas fields, the vessel being provided with at least two submersible hulls (10), a work platform (27), elevated to a secure level above the water line (23), and upright columns (11) on said hulls to carry said work deck, the element extending horizontally from the underside of one of said submersible hulls (10) to the underside of a second submersible hull (10), to form a stress absorbing bridge having considerable horizontal spread between the bottom skin plating (16) of the respective submersible hull. The element may be formed as a displacing ballastable body or as an oil storage tank 24, and may have columns 26 and a tower 25.

FIG. 3

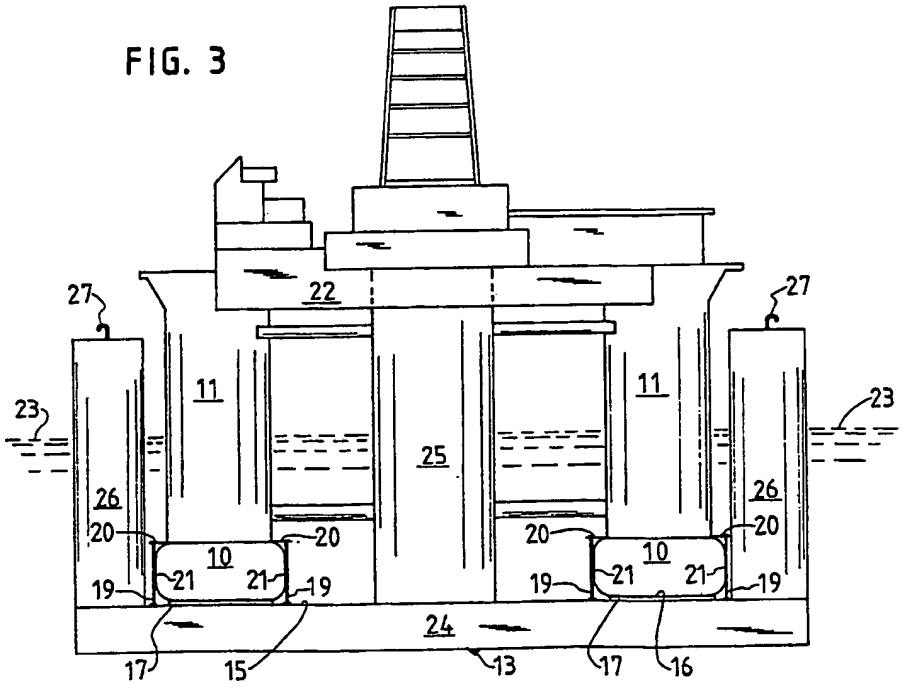

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FIG. 1

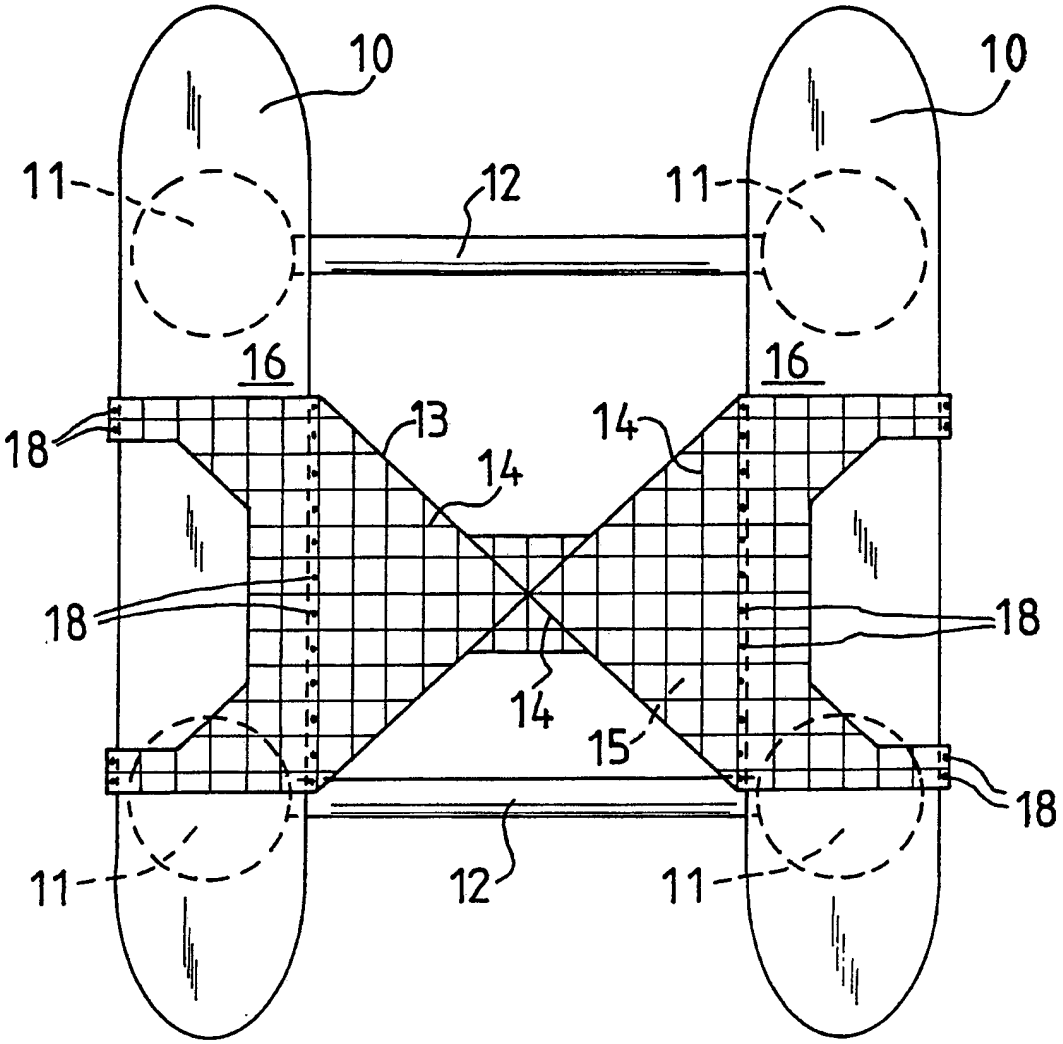
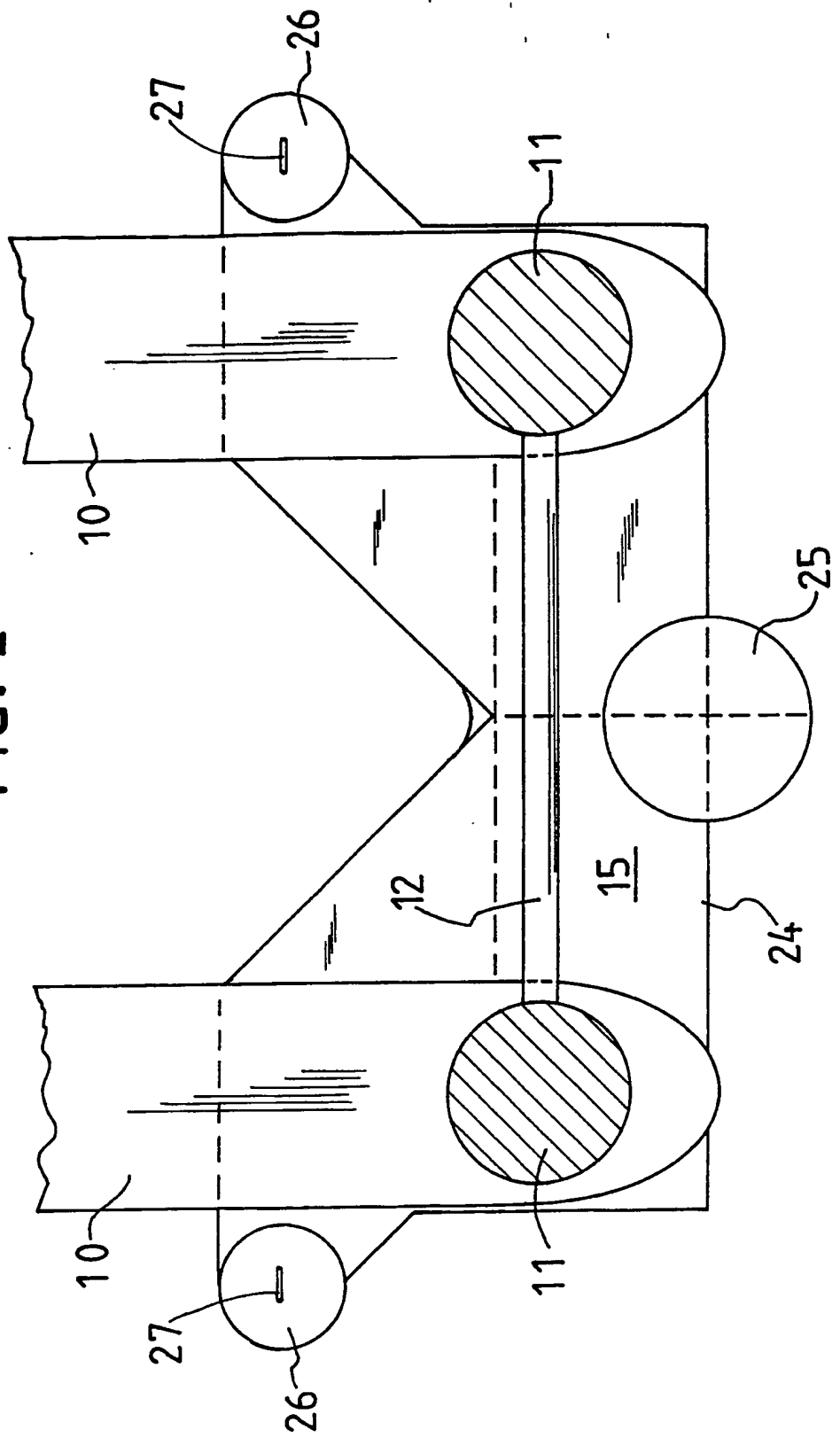


FIG. 2



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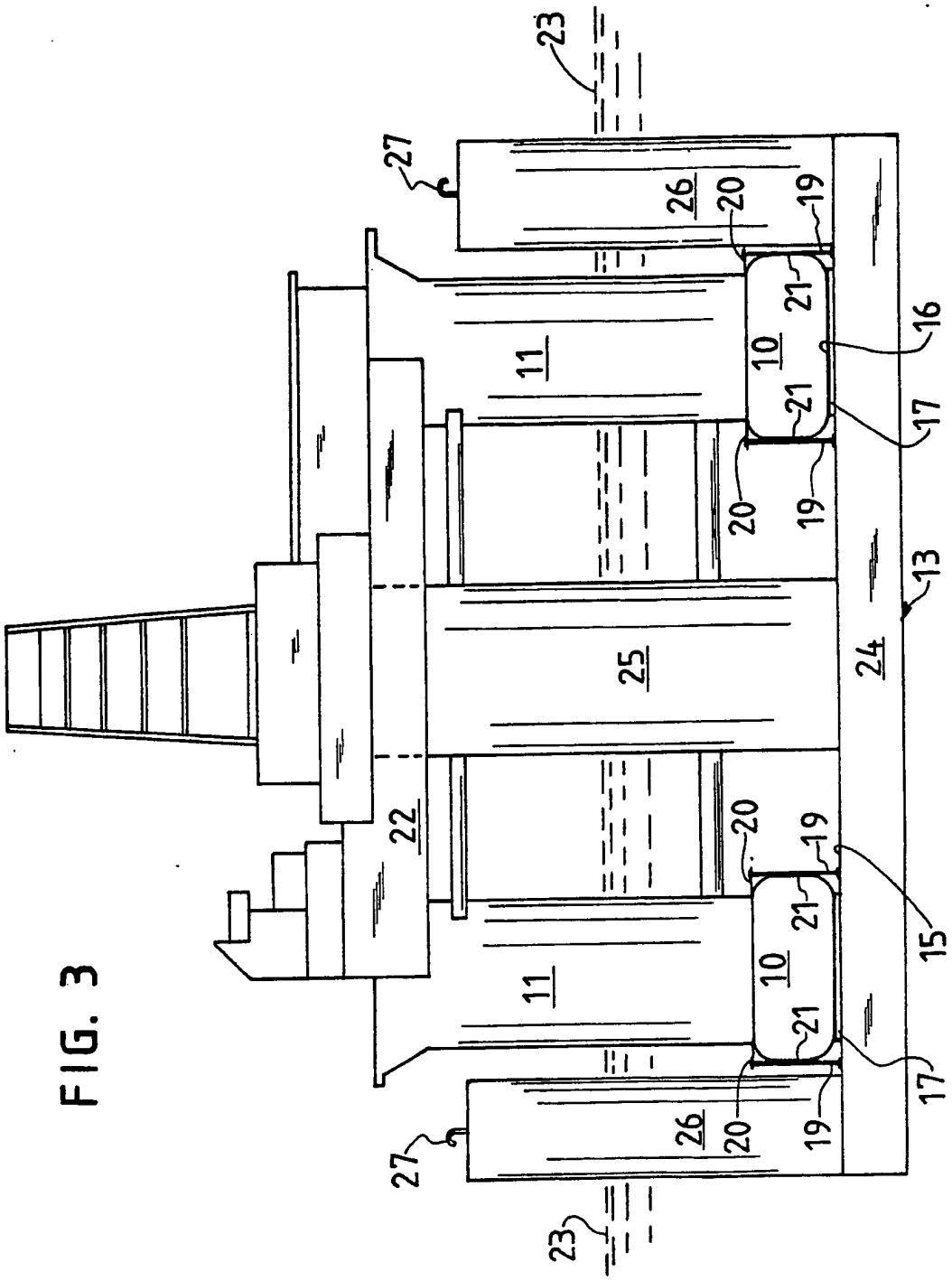

A REINFORCEMENT ELEMENT FOR OFFSHORE WORK VESSELS

This invention relates to a reinforcement element for a semisubmersible, elastically anchored offshore work vessel, e.g. for development of oil and gas fields, said vessel being provided with at least two submersible hulls, a work platform being elevated to a secure level above the water line and upright columns on said hulls to carry said work deck.

When designing new vessels, or upgrading existing vessels, of the above kind, one has to consider the demands for minimal movements at various work operations, safety, availability and good housing conditions. A design having enhanced stability and reduced motions also reduces the loads on anchoring means.

The economic reality when employing these kinds of vessels also amounts in a striving towards the largest possible pay load on the platform within the decided concept.

For example, drill rigs are converted into production rigs, which means that a considerable amount of process equipment will be added to the work deck. Usually the added weight is compensated for by providing sponsons on the submersible hulls, in order to increase displacement and lower the centre of gravity. Further, the water line area is increased by mounting larger fenders at the columns. Also, the box section platform and the bracings are amplified. All these modifications result in a large amount of welding work, which makes the conversion expensive.

One object of the present invention is therefore to provide a reinforcement element which may be used both for increasing displacement and lowering of the centre of gravity and which also can be used for increasing the water line area. Another object of the invention is to enable this modification to be made without large amounts of welding.

These objects are achieved according to the invention through extending said element horizontally from the underside of one of said submersible hulls to the underside of a second submersible hull, to form a stress absorbing bridge having considerable horizontal spread between the bottom skin plating of the respective submersible hull.

According to a preferable embodiment of the invention, the element is bolted by means of bolt connectors comprising bolts which extend vertically downward from the upper side of the respective submersible hull.

Preferably, the element is pressed by means of the bolt connectors against said bottom skins, via intermediate, elastically compressible distance means.

According to another embodiment of the invention, the element is formed as a displacing, ballastable body. This body may be a storage tank for crude oil.

Preferably, the element is provided with at least one vertical column extending up above the operational water line of the vessel, at a distance from the vessel's centre of buoyancy.

One embodiment of the invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Fig. 1 is a diagrammatical plan view showing an off-shore vessel from below, incorporating a reinforcement element according to the invention,

Fig. 2 is a fragmentary part-sectional plan view from above of a second embodiment of an off-shore vessel with a reinforcement element of the invention, and

Fig. 3 is an end view of the vessel of Fig. 2.

Fig. 1 shows the submerged parts of a semi-submersible platform, in operational condition, with two pontoon hulls 10 and four vertical columns 11 supported on said hulls. The columns are connected in pairs across to the opposite pontoon hull by means of a respective bracing 12.

A horizontal reinforcement element 13 extends horizontally between the two pontoon hulls 10, and is provided with lateral, longitudinal and diagonal frame ribs. The element has a considerable spread in the horizontal plane and abuts with its upper side 15 against the bottom plating 16 of the hulls, via intermediate distance means 17 (see Fig. 3) of an elastically compressible material, e.g. wood, plastics or rubber.

The element is mounted on the pontoon hulls 10 by means of a large number of bolt connectors 18, comprising long bolts 19 extending from brackets 20 at the upper side of the pontoon and vertically down along each side 21 of the hull as Fig. 3 shows. On account of their length, these bolts have a considerable amount of elasticity and may therefore be tightened to a suitable pretension, at which the distance means 17 are partly compressed. During sea heave, the tension on the bolts

will fluctuate depending on the direction of motion. At the same time, the compression of the distance means will vary.

The reinforcement element shown in Fig. 1 forms a floor like, rigid connection between the two hulls, without any closed chambers or tanks. The element reduces stress loads on the deck box 22 (see Fig. 3) and the bracings 12 considerably. At the same time, on account of its large horizontal area, the element contributes to a reduction in heave motion. In this embodiment, the element is asymmetrically placed. This may be advantageous, e.g. when converting a drill rig into a production rig, wherein a processing plant for separation of oil, gas, water and sludge is mounted at one end of the work deck. By mounting the reinforcement element at the same end of the work deck, the centre of gravity can be maintained at an acceptable level, longitudinally. Also, the heave motion will be reduced, because the element is located at a substantial distance from the water surface 23, where the heave motions are reduced considerably in accordance with "the Smith-effect".

When attaching the element 13, four tugs may be used, each being provided with wire lines which are connected to each corner of the element and by means of which the tugs may manoeuvre the element to the right position below the offshore vessel. Thereafter, the element provided with distance elements 17, is deballasted until it abuts and presses upwards against the bottom skin of the pontoon hulls, and the bolt connectors 18 may be mounted.

The reinforcement element 13 shown in Figs. 2 and 3 is designed as a closed body 24, forming a storage tank for

crude oil. The tank makes it possible to store a few days of oil production, so that a shuttle tanker may be used for transfer of oil ashore at certain intervals. The storage tank 24 forms a gas dangerous space which according to the invention is separated from the work areas and living quarters of the vessel.

The body 24 is provided with a central tower 25, extending up to the deck box 22 and enables communication between the body 24 and a process plant on the deck. The tower may at its bottom comprise remotely disconnectable connectors for riser lines, and further up, pump rooms and passages for inspection and service.

Further, the element extends somewhat beyond each outer hull side 21 to form bases for two vertical columns 26. These run upwards to about the same level as the bottom side of the deck box. The purpose of these two columns 26 is to provide enlarged water line area at a distance from the float centre of the vessel. The columns communicate with the atmosphere via valves 27, located at the top of said columns, in order to eliminate the creation of overpressure in these parts of the construction.

Thus, as the reinforcement element can be designed with inner storage tanks and means to enlarge the water line area, and because it may be provided with connectors for riser lines, it is possible to avoid costly redesign of an existing off-shore vessel, when it is converted into a production rig. The entire element may be preproduced at a shipyard and connected to the platform, without it having to be drydocked or alternatively without a lot of underwater welding.

The invention is not limited to the above described embodiment, but several modifications are possible within the scope of the accompanying claims. For example, the form of the element may differ from the drawings and other means may be used for attaching the element to the hulls. The reinforcement element may be utilized for new platforms.

CLAIMS

1. A reinforcement element for a semisubmersible, elastically anchored offshore work vessel, e.g. for development of oil and gas fields, said vessel being provided with at least two submersible hulls, a work platform being elevated to a secure level above the water line and upright columns on said hulls to carry said work deck, wherein said element extends horizontally from the underside of one of said submersible hulls to the underside of a second submersible hull, to form a stress absorbing bridge having considerable horizontal spread between the bottom skin plating of the respective submersible hull.

2. An element as claimed in claim 1, wherein it is bolted by means of bolt connectors comprising bolts which extend vertically downward from the upper side of the respective submersible hull.

3. An element as claimed in claim 2, wherein it is pressed by means of the bolt connectors against said bottom skins, via intermediate, elastically compressible distance means.

4. An element as claimed in any of claims 1 to 3, wherein it is formed as a displacing, ballastable body.

5. An element as claimed in any one of the preceding claims, wherein it forms a storage tank for crude oil.

6. An element as claimed in any one of the preceding claims, wherein it is provided with at least one vertical column extending, in use, up above the operational water line of the vessel, at a distance from the vessel's centre of buoyancy.

7. A semisubmersible vessel including a reinforcement element as claimed in any one of claims 1 to 6.

8. A reinforcement element substantially as hereinbefore described with reference to and as shown in Figure 1 or Figures 2 and 3 of the accompanying drawings.

9. A semisubmersible vessel including a reinforcement element substantially as hereinbefore described with reference to and as shown in Figure 1 or Figures 2 and 3 of the accompanying drawings.

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